



6. Andrew Shephard, National Undersea Research Center

Undersea Gas Hydrate: Interaction with climate and deep-sea biology

GOM Hydrates R&D Workshop
August 9-10, 2000
Houston, TX

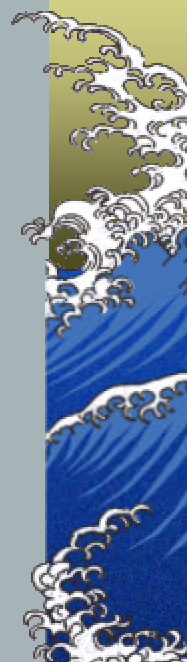
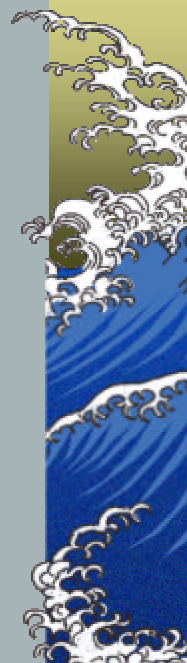
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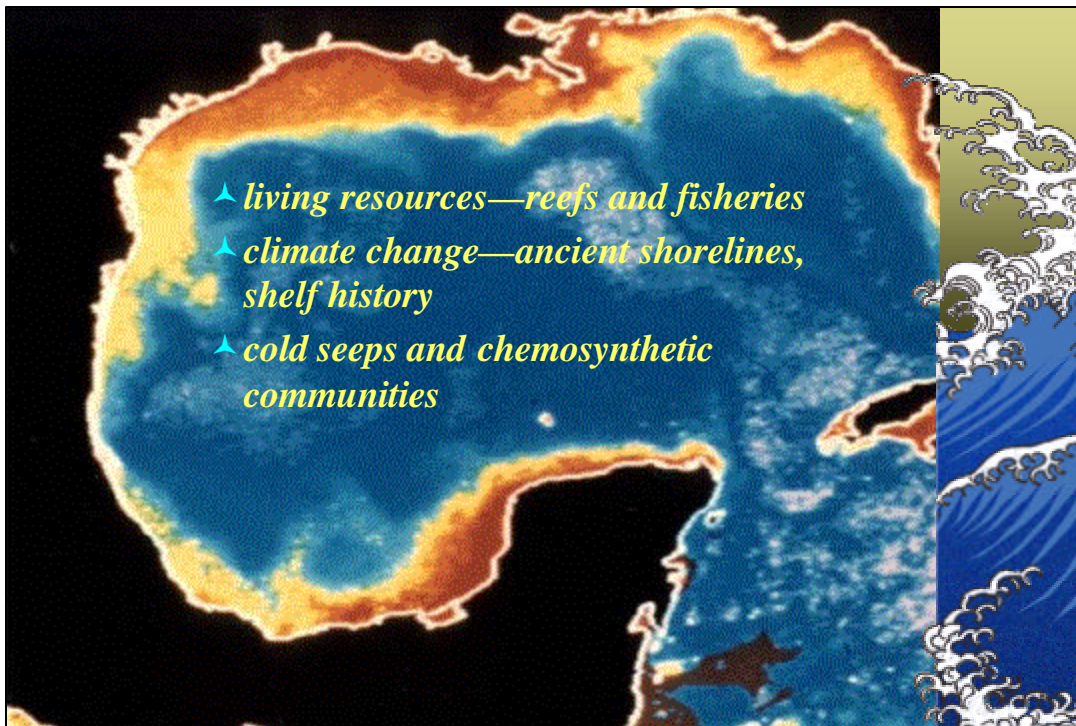
In situ Undersea Technology

- ▲ *oceanography by divers or submersibles*
- ▲ *observations, samples, experiments*
- ▲ *precise locations*
- ▲ *events*
- ▲ *inaccessible places*



- ▶ *NOAA grants to regional centers*
- ▶ *undersea technologies, expertise, and funding*
- ▶ *open competition via peer review*
- ▶ *relevant (NOAA/national) directed science programs*





NOAA Interest in Gas Hydrates

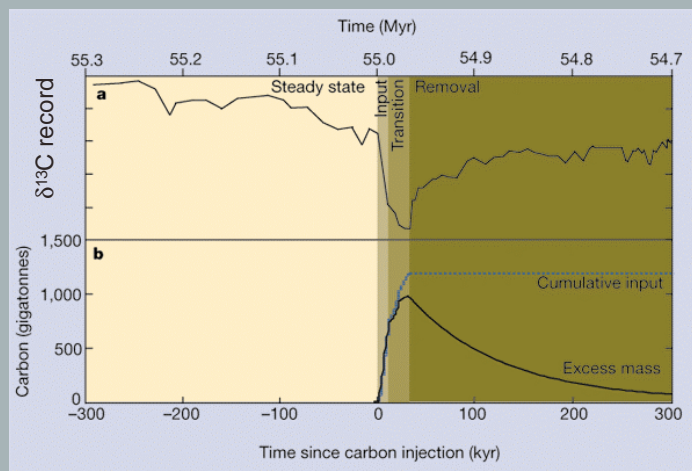
- ▲ “. . .development of policies that strengthen the links between **environmental stewardship and economic growth** is a core concern of the Department of Commerce.”—*DoC Secretary, Dr. R. Brown*
- ▲ “Although fewer marine than land species have been described, in some respects the **marine realm is more diverse**. All but one of the world's 33 phyla are found in marine environments, 15 exclusively so.” -- <http://www.wri.org/biodiv/b04-gbs.html>
- ▲ “**Earth's climate system** has varied substantially in the past, often with severe impacts on humankind. . .Dust Bowl of the 1930's. . . Little Ice Age. . .high- impact climatic fluctuations for decadal to century-long time periods.” - *NOAA, Decadal-to-Centennial Change*

Huge magnitudes of methane hydrate are buried on the ocean margins.

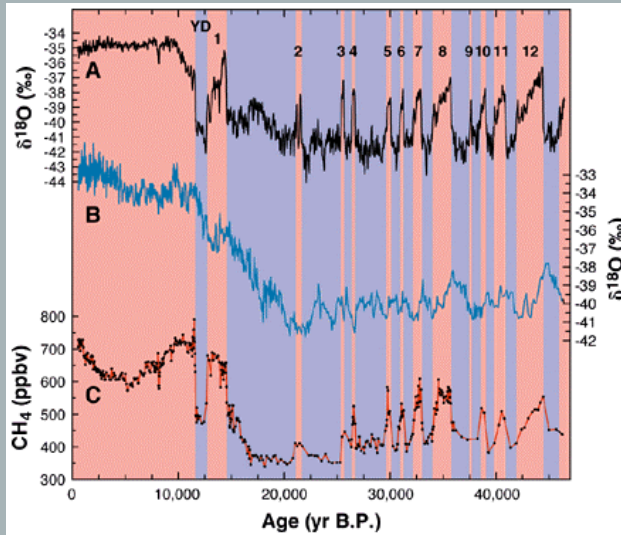


- ▲ 100,000 to 270,000,000 TCF, 100 times more in ocean
- ▲ Methane bound in hydrates 3,000 times the volume in atmosphere
- ▲ Estimates based on: geophysical surveys, few recoveries during drilling, extrapolation from explored localities to similar areas world-wide.

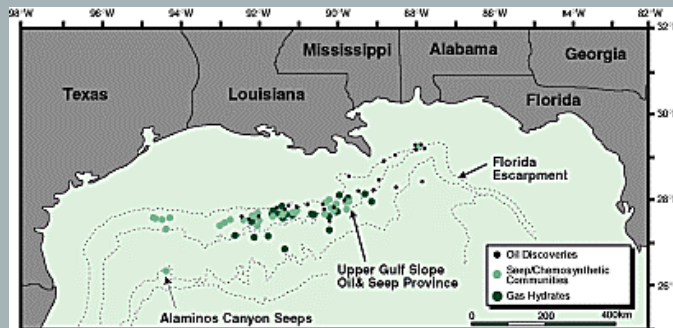
Can large-scale hydrate decomposition cause climate shifts? How fast and how large?



Annual to millennial (Blunier 2000; Kennett, 2000)



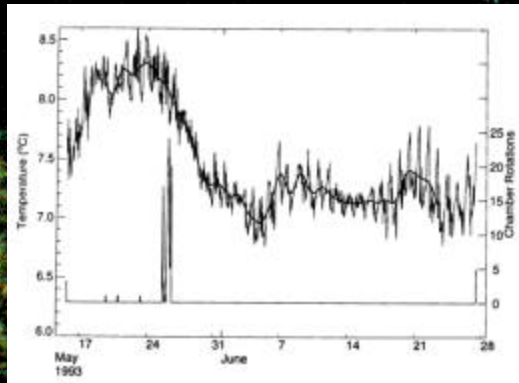
Shallow gas hydrate deposits in the Gulf



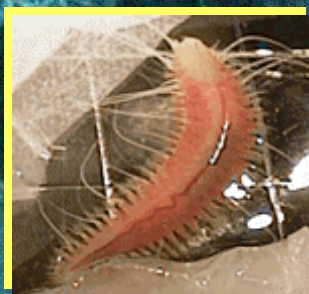
- ▲ gas hydrates outcrop on the Gulf seafloor at >400 meters
- ▲ beds experience rapid temperature fluctuations of up to 5 °C.



Hourly to annual (MacDonald et al. 1994)



Hydrate Beds— Ecotone or Biotope?

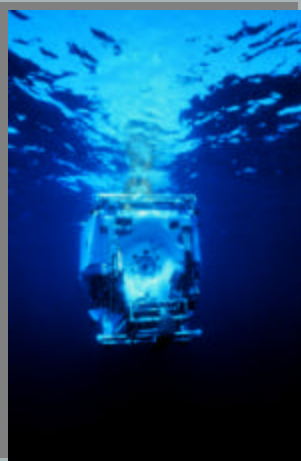


- ▲ *Shallow gas hydrates are part of a complex ecosystem with new and exotic animals*
- ▲ *Life in Extreme Environments*

What needs to be done?

- ▲ Exploration
- ▲ Research– in situ and in vitro
- ▲ Technology development
- ▲ Partnerships– funding and expertise
- ▲ Outreach and public support

“Life without Light: The Edge of the Gulf” 2000 *Alvin* cruise



Sen Gupta, LSU and Bernhard, USC,
“Foraminifera of Hydrocarbon Vents, Gulf of Mexico: Diversity, Ecology, Ultrastructure, and Physiological Adaptations”

Van Dover, College of William and Mary,
“Comparative biodiversity in seep, vent and intertidal mussel beds”

MacDonald, Texas A&M University,
“Submersible Sampling of Escarpment Sites during Year 2 of the MMS deep Gulf of Mexico research program”

Rose, National Environmental Technology Lab,
“Presence and stability of exposed gas hydrate beds in the Gulf of Mexico”

